A MANAGEMENT PERSPECTIVE ON THE ROLE OF INFORMATION PRODUCTION IN THE ORGANIZATION

Richard L. Wooten

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THESIS

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IN THE ORGANIZATION

by

Richard L. Wooten

September 1979

Thesis Advisor: J.W. Creighton

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T191970

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) A Management Perspective on the Role of Information Production in the Organization		5. TYPE OF REPORT & PERIOD COVERED Master's Thesis; September, 1979 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Richard L. Wooten		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Postgraduate School Monterey, California 93940		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Postgraduate School Monterey, California 93940		12. REPORT DATE September 1979 13. NUMBER OF PAGES 52
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) Naval Postgraduate School Monterey, California 93940		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

Approved for public release; distribution unlimited

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

information
information system
organization
decision process

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The explosive growth of information technology in the last decade has caused a demand for experienced information system managers far beyond the present supply. Consequently, many of these positions are filled by personnel who may lack a comprehensive understanding of the role of information production in the organization. This paper addresses organization processes and interactions of which the information system manager must be made aware in order to perform his job effectively. Discussion

No. 20 (cont.):
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Submitted in partial fulfillment
of the requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL

September 1979

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The explosive growth of information technology in the last decade has caused a demand for experienced information system managers far beyond the present supply. Consequently, many of these positions are filled by personnel who may lack a comprehensive understanding of the role of information production in the organization. This paper addresses organization processes and interactions of which the information system manager must be made aware in order to perform his job effectively. Discussion includes organization purpose, structure, decision processes, and information production. When appropriate, descriptive models were developed in order to better understand the synergistic relationships which exist. Particular attention was given to the need for systematic valuation of organization information products, and development of the "product-worth function" is proposed as a possible approach to this problem.

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FORWARD

Information system management is rapidly becoming recognized as a field requiring specialized training and background. However, a tendency exists to associate information system management with the highly sophisticated equipment it employs and to place emphasis on the technical aspects of the job. As a consequence, information management is often delegated to personnel who are technically knowledgeable but may lack a comprehensive understanding of the role of information products in the organization. Without this understanding, the information system will probably lack direction, have few clearly defined goals or objectives, and fail to meet important organizational needs. Such systems tend to emphasize quantity and not quality of output and the production of information becomes an end in itself. The symptoms are inefficiency, ineffectiveness, and wastefulness. Prevention requires that management maintain an awareness of the fundamental role of information production in the organization. Such is the intent of this thesis.

I. INTRODUCTION

Through evolution, man has differed from his not-so-fortunate ancestors in many important ways. Homo erectus stood on two feet, freed his hands and added a new dimension to his future potential. Also, his brain size was large relative to other animal species, the combination which allowed him to out-think, out-adapt, and out-develop his immediate rivals in the struggle for survival. But, one of his most important abilities is often overlooked, the capacity for high-level communication within his species. He and his fellows developed structured, albeit generally informal and primitive, processes with which ideas, events, and desires could be recorded, retrieved and transferred among his kind. It could be said, "early man survived because he organized, and he was able to organize because he comprehended the utility of information and the concept of information processes."

A. HUMAN ORGANIZATION AND INFORMATION PRODUCTS

Human organization, regardless of purpose, goals or objectives, has an inherent need for structured processes which identify, collect, store, retrieve, disseminate and utilize substantive information. A procedural diagram depicting the sequential nature of these inter-related

processes is shown in Exhibit 1. Taken in the aggregate, they represent an "information system." This structured approach to the production of useful information is analogous to a simple manufacturing plant which purchases raw material (data) and fabricates marketable objects (items of information). An information system product can be thought of as a structured package consisting of at least one, usually many, information items associated with some common area of organizational responsibility. Form and format of these products are governed by user need and preference and are designed to promote maximum product utilization. Since information supports decision-making processes by virtue of the fact that it reduces uncertainty, the apparent worth of information products is subjective and primarily dependent on the relative importance assigned to them by users within the organization. Information which is unused has no discernible effect on organization decision outcomes, and therefore no meaningful worth. The production of unused information items not only represents a waste of organization resources but also tends to dilute the overall effectiveness of information products [Ref. 1].

All elements of information system output should have a usefulness recognized by at least one decision center or decision maker within the organization and be readily traceable to one or more organization objectives. What type of information product is needed? What data must be

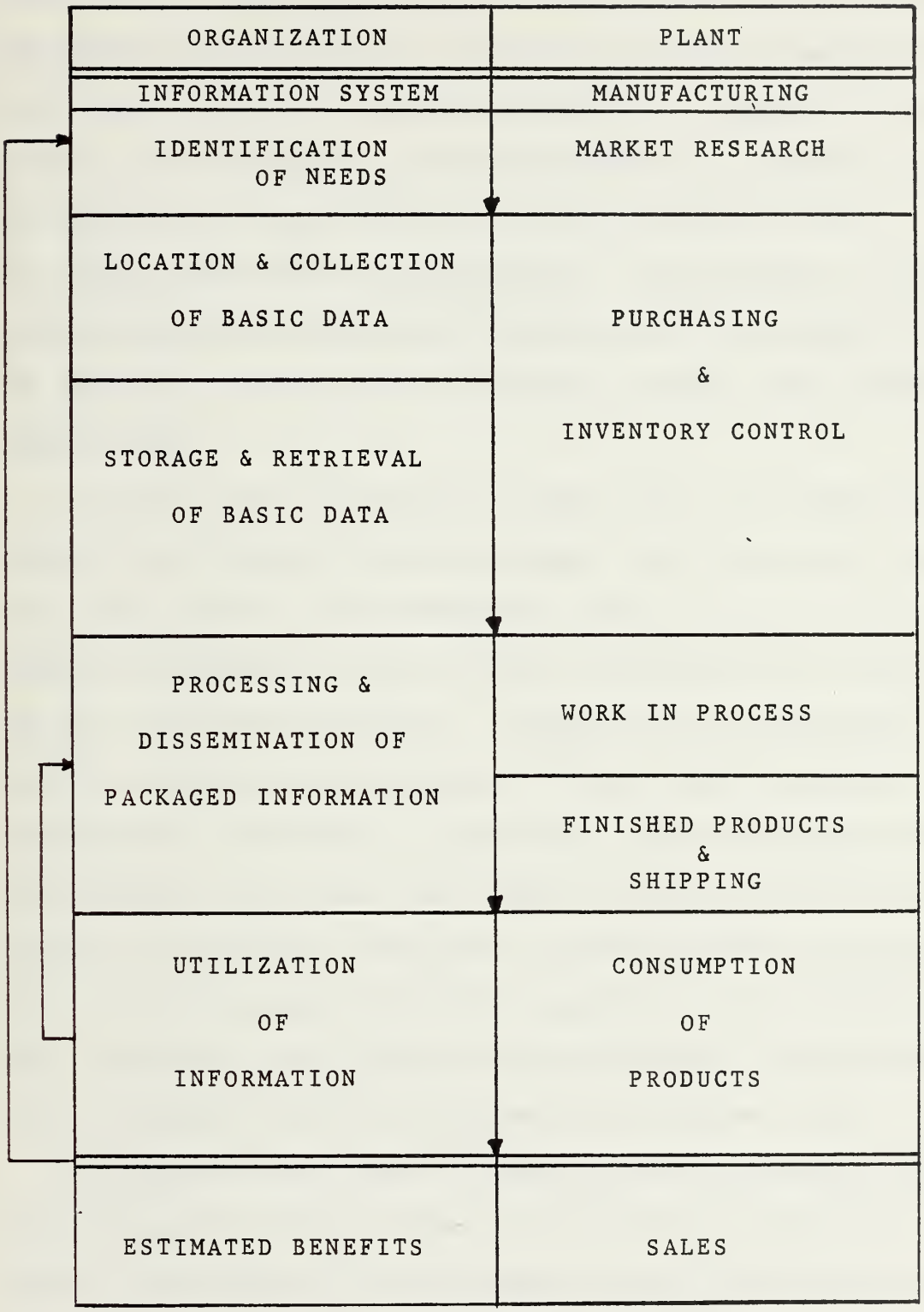


Exhibit 1-THE MANUFACTURING ANALOGY OF STRUCTURED INFORMATION PROCESSES

collected? These and similar questions have to be resolved by organization users and information system management in the early stages of product development. Because the manufacture of information products requires an expenditure of resources, a user market for these products should be established prior to production. Furthermore, the properly structured information system should be sensitive to changes in this market and able to modify its products accordingly.

Location and collection of basic data may seem like a relatively straight forward process, but this, more than any other step in the information chain, is apt to be a major contributor to the eventual utilization or rejection of any information product. Production of information requires data as raw material. If this data is partly unavailable, untimely, or inaccurate, the end product will have dubious value and some degree of user rejection is almost a certainty. Detection, identification and correction of faulty data collection procedures are probably the most difficult, yet among the most important, tasks which face information system management and system users.

Storage and retrieval of data is the step which links the collection process with the information production line. Formulation and maintenance of an organizational data base is equivalent to the establishment of a raw materials inventory stock for input to production work-in-process. In the case of information systems, most of the raw

material inventory is perishable and must be replaced on a frequent basis. That is to say, basic data has a limited shelf life relative to the manufacture of useful information products, and dynamic maintenance of this data base is critical to the success of the system.

Dissemination is a step in the structured information process which converts basic data into useful information products and provides these products to users within the organization. It is similar to production work-in-process and shipment of finished goods. Basic algorithms used to process data are obviously important to the validity of the product; but form, format, and timeliness of the finished item are the keys to user acceptance and the realization of potential product utility. Access and availability, clarity and completeness, and accuracy and consistency are of primary concern during the dissemination process.

Although the user of information products is at the extreme end of the structured information process chain, he is of the utmost importance to the ultimate effectiveness of any organization information system. Regardless of the type or mix of processes for manufacture and exchange of information within the organization, these processes in the aggregate must satisfy identified information requirements, be based on reasonably accurate and timely data and, above all, generate information products having recognized user utility.

II. OBJECTIVE AND SCOPE

The objective of this thesis is to promote the design of better information systems by providing the information system manager with a perspective on the role of information production in the organization. The reader is presented with a deductive overview of organization purpose, structure, decision processes, and information production, and principal relationships which should exist in a properly functioning system are described in some detail. A final section is dedicated to the need for valuating organization information products and proposes a novel approach to this problem. A liberal use of descriptive models has been employed throughout as a means of promoting an understanding of the viewpoints expressed in the discussion material.

III. PLACING THE INFORMATION SYSTEM IN PERSPECTIVE

A definition of "organization" that can be found in Webster's dictionary is "the unification and harmonization of all elements of a work art." The success of this type of organization is readily measured by the level or degree of sensory pleasure during the act of perception (though more often than not there is a wide difference of opinion among qualified art critics). The marginal value of a relatively small change such as a modification of color, hue, shape or structure might be established by obtaining a consensus of before and after impressions and noting the incremental improvement (or degradation) in the perceived value. Similarly, an organization of people can be considered as a unification of purpose and a hierarchial harmonization of skills and talent.

Unfortunately, attempts to assess the relative value or worth of human business organization is a much more challenging task than subjective evaluation of art objects. Business analysts often employ units of corporate input and output to develop comparative measures such as return on investment, income to sales, growth, or profit for use in assessing how well an organization functions. This type analysis provides a measure of relative external value, that is, "how does the performance of this particular organization compare with competing organizations sharing

a common business environment?" While this approach is the most commonly used and generally accepted method of corporate dissection, these data offer little more insight to the potential functional effectiveness of the organization structure than measurement of the zero to sixty acceleration of an automobile gives the observer knowledge of the intricacies of the engine.

To a pure organizational theorist, the inherent worth or intrinsic value of an organization is a measure of the synergistic combination of organizational elements. That is, given the environment, "how does the actual output or benefit of an organization compare with the hypothetical maximum output or benefit which could be expected if available resources and talent were optimally combined?" This measure, assuming that it or a good approximation of it can be obtained, is simply the ratio of how efficient the organized processes are to how efficient they could be and can be referred to as the "synergistic ratio." The synergistic ratio will be constrained to values between zero and one, anarchy represented by the former and total harmonization by the latter.

A. THE MANAGEMENT INFORMATION SYSTEM AS PART OF THE ORGANIZATION

From a management systems viewpoint, the "business organization" can be modeled as an integrated but stratified decision-making process designed to maximize organizational

benefits within the existing environment. Of this viewpoint, Mockler [Ref. 2] has said: "This systems approach forces the manager to look upon his business organization as an information network with the flow of information providing the decision makers at various management levels with the information needed to make decisions of all types." Obviously, this approach to the structuring of organizational systems leaves no reasonable doubt of the need for a well thought-out and well planned corporate infrastructure which can collect, store and process data and distribute useful information to organization decision centers. This infrastructure is commonly called an "information system" and is often referred to as a "management information system (MIS)" when its primary objective is the reduction of uncertainty during corporate decision-making processes. This paper and its inferences are primarily concerned with MIS-type information products, those which support corporate decisions.

Luchsinger and Dock [Ref. 3] describe the business organization as made up of identifiable subsystems which can be categorized by function. This is to say, all work performed within an organization is interrelated and interdependent, yet there are distinct differences by which resource expenditures are identified with specific intra-organizational responsibilities and objectives. In all, there are five such subsystem categories:

1. Productive or technical subsystems are concerned with work which transforms inputs to outputs.

2. Supportive subsystems are responsible for acquisition and disposition of inputs and outputs.

3. Maintenance subsystems assure the preservation of production related processes.

4. Managerial subsystems control and affect organizational goals, objectives, tasks, personnel and material resources.

5. Adaptive subsystems are required for the determination and implementation of change.

Information systems do not lend themselves easily to a subsystem categorization as above. Rather, the organizational information system is the "synergistic glue" that bonds otherwise disjointed interfunctional and intrafunctional subsystems into a cohesive and productive force. The more effective the production and transfer of useful information becomes, the closer the organization can approach an optimum utilization and harmonization of available resources.

The formulation and evolution of major organizations require concomitant development of appropriate information infrastructure. The resulting lattice of interrelated and interdependent information processes and the relationship these processes have to the organization functional elements (subsystems) can best be equated to the relationship a web

has to the spider which draws sustenance from it as shown in Exhibit 2. Each functional subsystem within the organization is intrinsically coupled to others and to the outside environment by means of a cohesive network of structured information processes. Collectively, these processes represent the corporate management information system and the interdependent paths along which data is collected, processed, and disseminated.

The concept of the information system as a network is an approach adapted from Blumenthal [Ref. 5]. The organization is described at the lowest level as "activities affecting the condition or state of the system." In the aggregate, these activities comprise the six functional subsystems described earlier. Decision centers associated with functional areas require information about the corporate and environmental state variables with which they must interact. Thus, the organization is viewed as a number of functional units interconnected by a network of information flow.

Early management recognition of the need for appropriate information infrastructure is an integral part of corporate evolution and the key to successful organization. Furthermore, careful consideration of information system design, implementation and adaptability is probably the single most important factor contributing to company growth and survival.

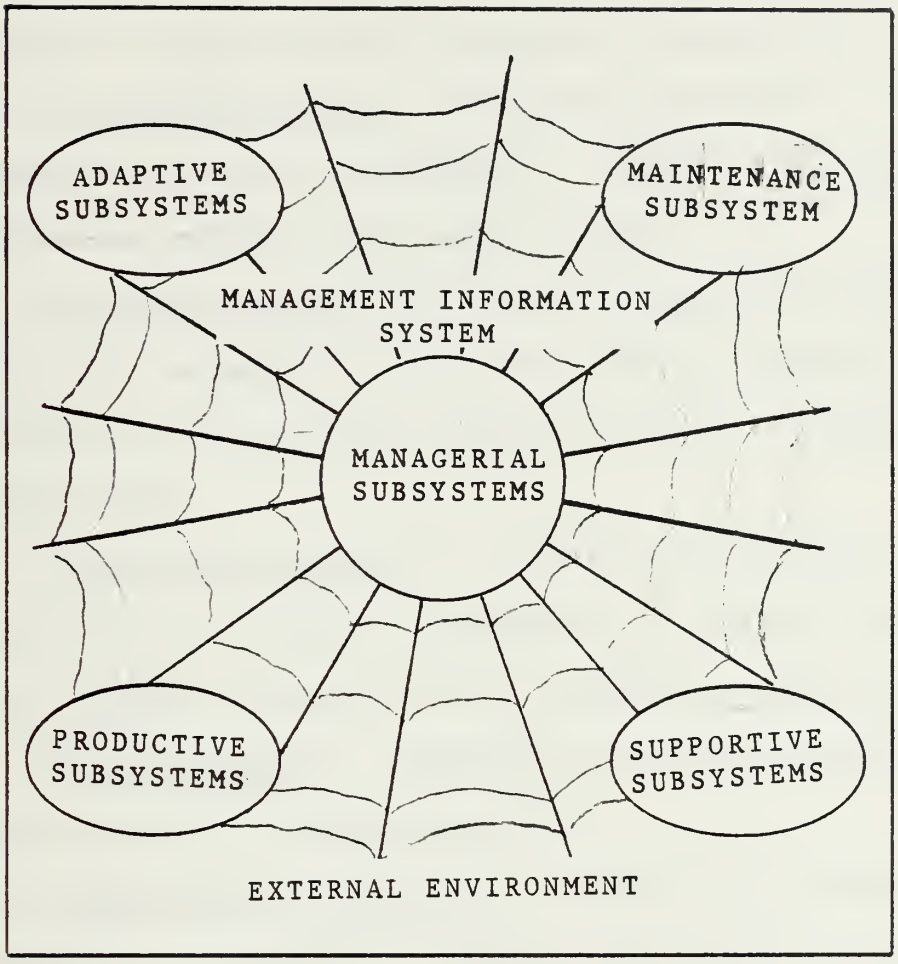


Exhibit 2-ROLE OF THE MANAGEMENT INFORMATION SYSTEM IN THE ORGANIZATION

B. INFORMATION SYSTEM APPLICATION

The corporate need for information products can be stratified into six somewhat distinct categories:

1. Strategic support: information products required by senior management to affect long-term corporate policy, plans and programs.
2. Tactical support: information products required by middle management to control the allocation of corporate resources and products within the market environment.
3. Operational support: information products required by production management to control day-to-day corporate operations and resource expenditures.
4. Fiscal support: information products required for control of corporate capital.
5. Administrative support: information products required to implement, execute and control corporate policy, plans, and procedures.
6. General support: information products required within and without the organization to maintain internal and external corporate harmony.

With a little thought it is not difficult to imagine the type of information products which apply to the six categories above.

Senior management must have information which provides insight into future corporate needs and challenges to make

an intelligent assessment of proposed long-ranged changes. Research concerning out-year industry and market trends, expected technology advances, availability of raw materials, government policies, and new market entries are typical of information required for strategic support.

Middle managers need to estimate what market conditions might exist in the immediate future in order to direct movement of corporate labor, materials, and finished products in a manner which most benefits the ocrporation in the near term. Timely reports on sales trends, demand fluctuation, competitor product lines, material prices, labor productivity, project progress and the like are information products which provide tactical support.

The production manager is responsible for implementation of middle management decisions. Accordingly, he must know what the current status of his functional area is and what the impact of accomodating change will be on a day-by-day basis. Daily reports concerning product and materials inventories, personnel status, plant equipment operation, work-in-process, and backl g status are typical information products which support operations.

Financial management requires detailed accurate and up-to-date accounting for all corporate business transactions associated with company resources. Also important are many various facets of the fiscal environment such as sources and costs of capital, exchange rates, inventory valuation, discount rates and tax laws. Business accounting

journals and ledgers, budget and expense reports, budgetary proposals, and audit reports are some of the information products which provide fiscal support.

The administration of corporate policy and internal procedures requires information concerning organization assets, structure, plans, policy, procedures and environment. Business and personnel transactions, acquisition and use of manpower, material and capital assets, regulatory and policy constraints and similar information products support the administrative function.

General support is a catch-all category for information products which cannot be directly identified with specific organizational decision-making processes but is nevertheless a basic part of any corporate information system. Newsletters, newspapers, informal memoranda, books, films and periodicals are just a few of the large number of information products which provide general support.

Manufacture of corporate information products,like any production line, requires a significant expenditure of company resources to establish and maintain production equipment and processes, raw material and finished goods, inventories, labor and talent pools, and an appropriate market distribution system. Accordingly, utilization is key to the economic viability of these products.

Exhibit 3 summarizes the five categories of corporate decision information use and the utilization structure

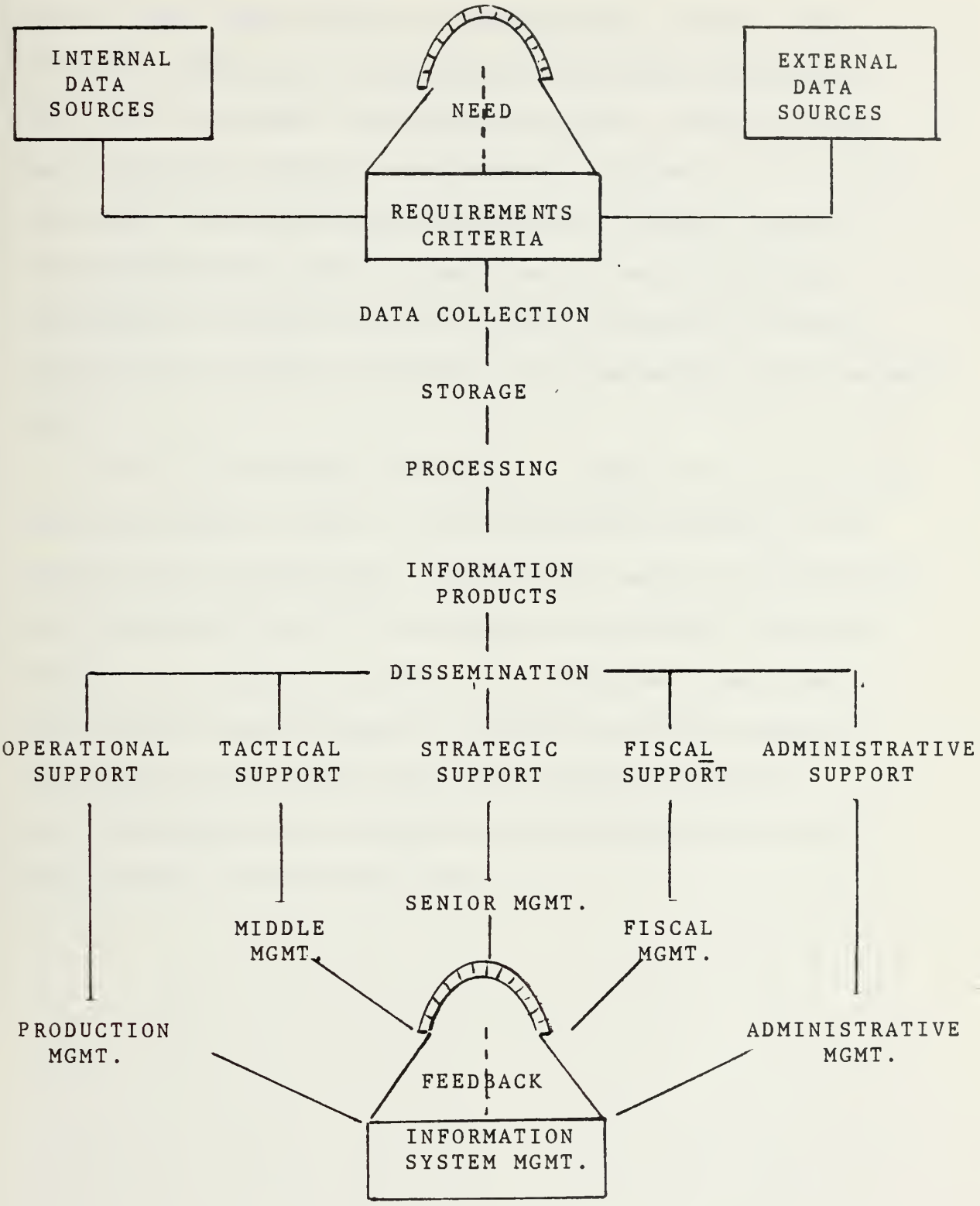


Exhibit 3- DECISION INFORMATION PRODUCT FLOW

which might exist within an organization. Solid lines show the existence of structured information processes, the flow of primary information products, and key management decision centers these products support. It is important that information product utility feedback systems be maintained and that dissatisfaction with existing information products as well as new information product needs can be quickly identified to information system management.

Thus far, important concepts of organization have been discussed and the role of the information system in the organization established. Because the need for information is inexorably bound to the myriad of corporate decisions which must be made each day, it is important that the information system manager be acquainted with organization decision processes which his products support. The following section describes these processes in sufficient detail to meet this need.

IV. THE DECISION REVOLUTION - A PROCESS FOR CHANGE

> Every organization is in a continuous state of change. Sometimes the changes are great, sometimes small, but change is always taking place. The conditions requiring these changes arise from both within and without. As a consequence, there is never-ending need for decisions which guide adjustments to change. The adequacy of these decisions for meeting an organization's current and developing internal and external situations determines the well-being, power, and future of that organization.
>
> We are coming to recognize with increasing clarity that the capacity of an organization to function well depends both upon the quality of its decision-making processes and upon the adequacy and accuracy of the information used. [Ref. 6] .

In the business organization, allocation of manpower, material,and capital to the five categories of functional subsystems (managerial, productive, adaptive, maintenance,and supportive) is based on identifiable needs. That is, justification for resource expenditure is usually expressed in quantifiable terms either as a substantive and desirable change to corporate functional processes or as an anticipated and verifiable improvement in quality or quantity of corporate benefit. The marginal impact of incremental change to functional systems is evaluated prior to management approval and assessed during and subsequent to implementation. Thus, change to functional system

processes, products,or procedures is judged apriori for potential worth and aposteriori as having realized this potential.

A. THE CORPORATE DECISION CYCLE

Corporate system changes occur in three sequential decision phases: recognition of need for and authorization to implement change, acceptance of implementation, and assessment of the need for further change. This marginal decision process, graphically described in Exhibit 4, is cyclic and an essential part of corporate evolution. Although our discussion of this cyclic process of corporate change, which can best be described as "decision revolution," deals with modification of existing systems, this same process is equally applicable to the creation of new systems.

Innovation, the generation or recognition of better ideas, opportunities, and novel approaches, must occur before systems can be consciously improved. Alternative systems modifications are analyzed and considered with respect to organization goals, objectives, and expected increase in net corporate benefit.

Decision Phase I is primarily associated with unstructured-type decisions [Ref. 7] involving relatively senior management levels and are the most critical relative to healthy corporate operation, evolution, and growth.

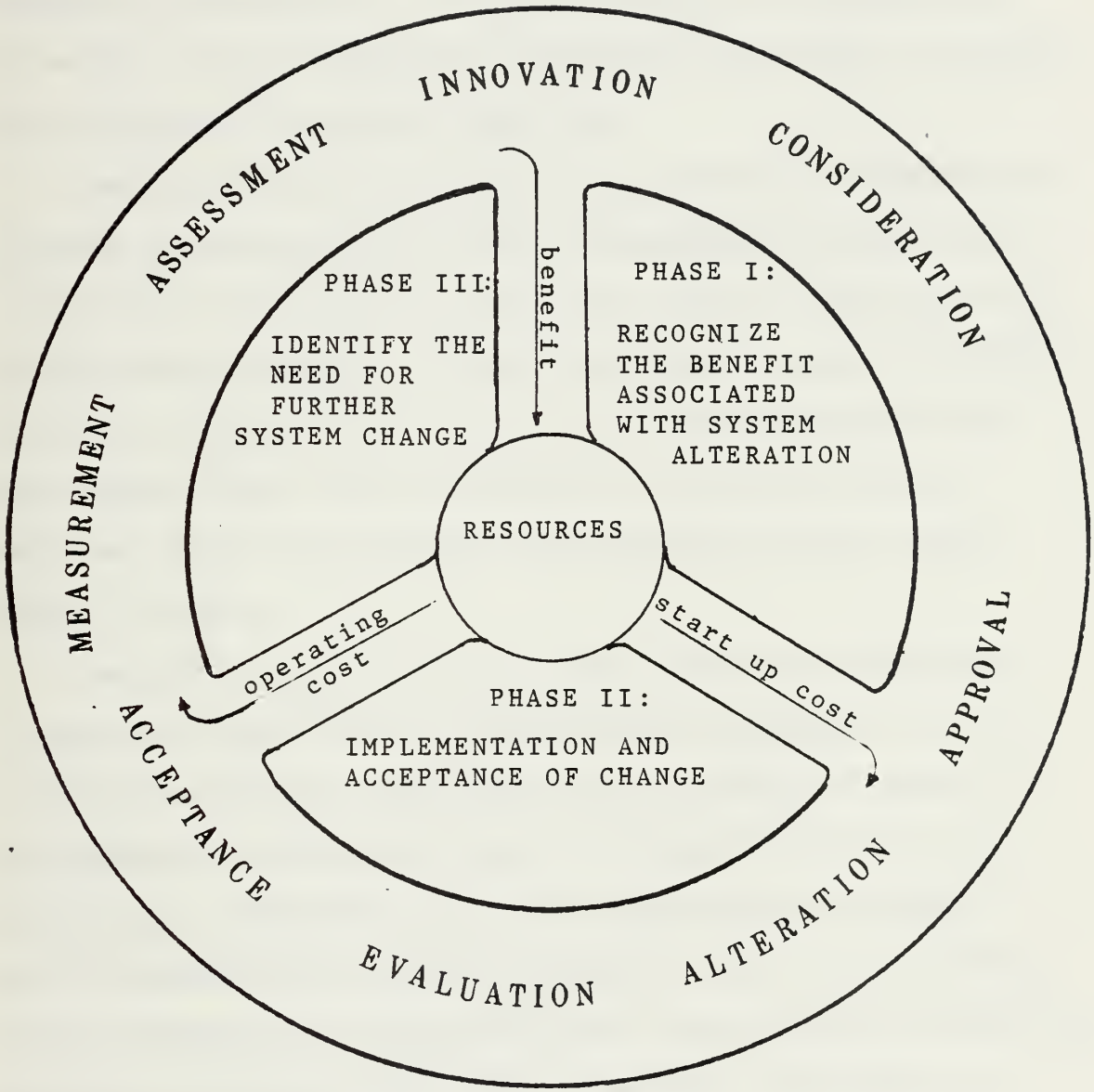


Exhibit 4-THE DECISION REVOLUTION

"Should a change to the present system be made?" At this point, the marginal uncertainty associated with an action decision is at a maximum. If the decision for change is affirmative, a flow of corporate resources is directed toward alteration of subsystem processes, products or procedures to achieve this end.

Decision Phase II concerns semi-structured operational control decisions which involve management acceptance (or rejection) of the system alteration effort during and following implementation. Final acceptance releases additional corporate resources for operation and maintenance of the new system (this could as easily be inflow as well as outflow since the alteration may actually reduce operational costs).

Decision Phase III is the last phase of the decision revolution cycle and involves periodic assessment of the modified system by management and evaluation of system weaknesses. During this phase, corporate benefits are assessed as marginally improved, degraded,or unchanged as a result of the system alteration. The bulk of management decisions are concerned with "fine tuning" the modified system to maximize efficiency. However, assessment of substantial system shortcomings requires semi-structured decisions which result in system innovations and their submittal to higher management for consideration. Thus, the decision cycle is reinitiated and the stage set for another "decision revolution."

Each major decision cycle represents the aggregate effects of a multitude of inter-related suborganizational production decision processes which emulate the decision revolution of Exhibit 4. Further, these processes can be categorized into three somewhat overlapping but clearly distinguishable decision categories: strategic, tactical and operational. The general relationship between these suborganizational decision cycles and the corporate decision revolution is pictured in Exhibit 5. Within the organization, the strategic decision cycle circumscribes all other decision processes. In other words, the tactical and operational decision cycles are subordinate to the goals and objectives of strategic management decisions. Similarly, operational decision processes (with the exception of general support functions) are subordinate to the requirements of tactical management decisions. The three suborganizational decision cycles are better described in tabular format as shown in Exhibit 6. Each decision cycle progresses from left to right beginning with decisions to make change, implementation and acceptance, and finally, assessment of the need for further change. The reader should note that a sequence of decision cycle steps can progress diagonally from upper left to lower right (e.g. Strategic Phase I, Tactical Phase II and Operational Phase III). Also, each decision depicted in the suborganizational decision cycle tableau is relatively dependent on and interactive with all preceding decision cycle steps.

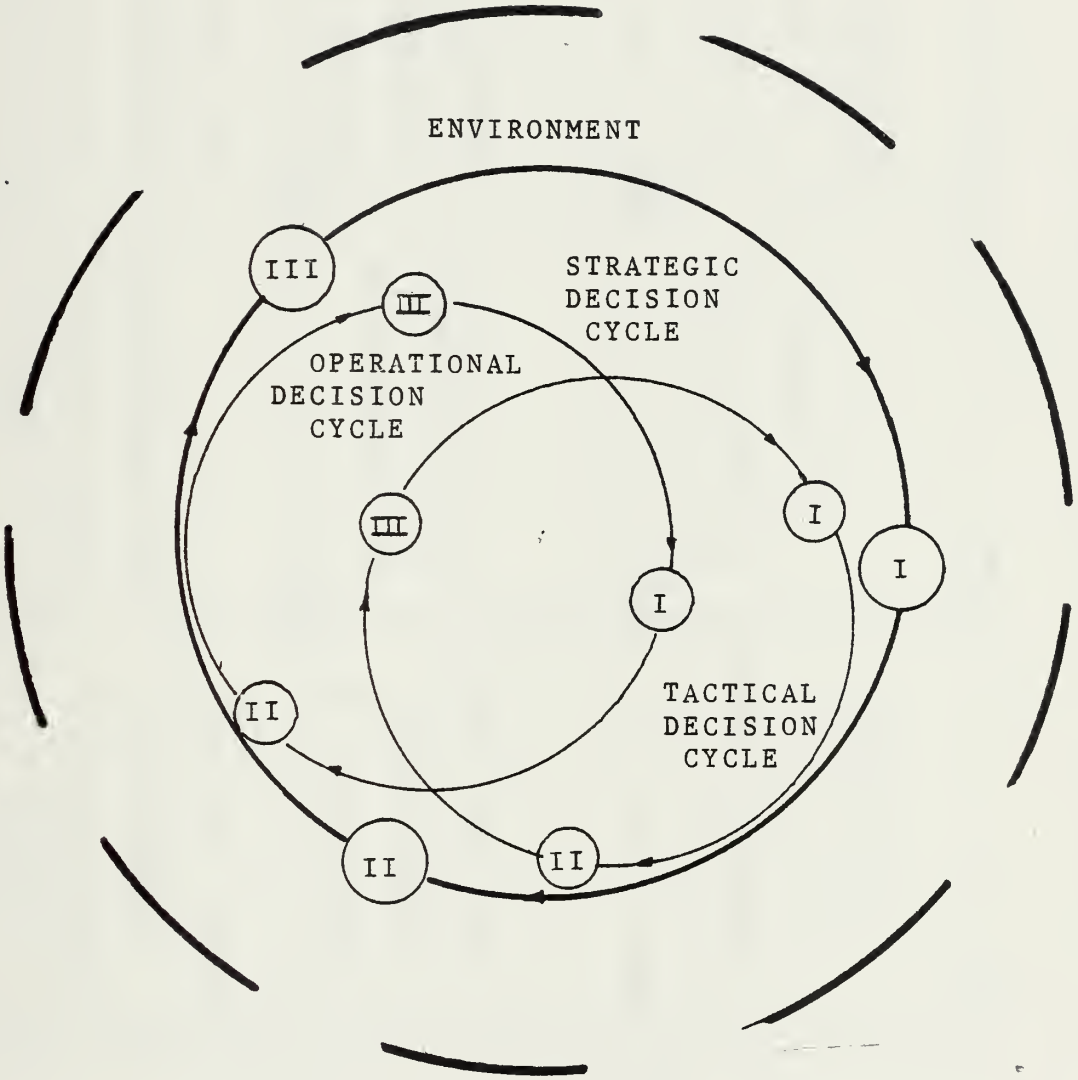


Exhibit 5-SUBORGANIZATIONAL DECISION PROCESS RELATIONSHIPS

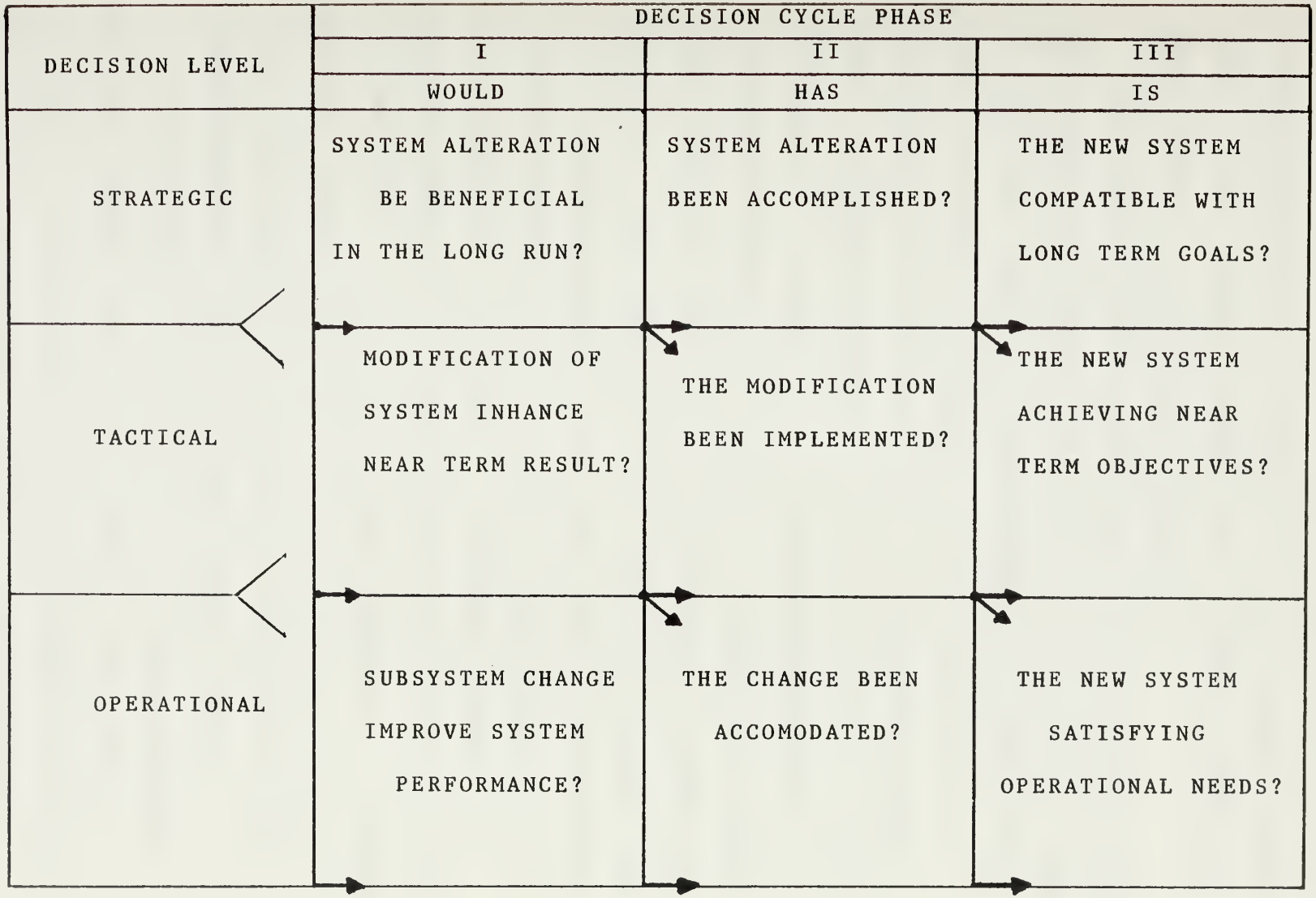


Exhibit 6-REPRESENTATIVE SUBORGANIZATIONAL DECISION CYCLES FOR CORPORATE EVOLUTION

The degree of mutual dependence or interaction between any two decisions is a function of the sequential proximity of these decision steps in the tableau, adjoining steps having the greatest interaction.

The "decision revolution" and "decision cycle" models which have been discussed here are another way of looking at relatively familiar decision-making concepts such as the "intelligence, design,and choice" model of H. A. Simon [Ref. 9] or the Rubenstein and Haberstrch model [Ref. 10] which proposes a continuous decision activity motivated by the objective of system transformation or change with emphasis on feedback. A comparison between these models and the "decision revolution" is shown in Exhibit 7. Each decision model describes a logical and cyclic decision-making process and each is initiated by a dissatisfaction with the current state and ends with the creation of a new state. Iterations between the decision phases are a necessary part of each process which can and often do preclude or delay completion of the cycle. However, the decision cycle for any particular state change will continue as long as the initiating factor (dissatisfaction with the current state) exists.

The "corporate decision revolution" and suborganizational decision cycle model describe the general mechanism by which organized systems change and evolve. This cyclic and rational approach to decision-making is basic to the synergistic concept of organized effort.

SIMON MODEL	RUBENSTEIN-HABERSTROH MODEL	DECISION REVOLUTION
INTELLIGENCE: IDENTIFY PROBLEMS	RECOGNITION OF PROBLEM OR NEED FOR A DECISION	PHASE III: ASSESSMENT & INNOVATION
DESIGN: INVENT, DEVELOP AND ANALYSE	ANALYSIS AND STATEMENT OF ALTERNATIVES	PHASE I : CONSIDERATION & APPROVAL
CHOICE: SELECT AND IMPLEMENT COURSE OF ACTION	CHOOSE (THE BEST) ALTERNATIVE	
	COMMUNICATION AND IMPLEMENTATION OF DECISION	PHASE II : ALTERATION, EVALUATION, AND ACCEPTANCE
INTELLIGENCE: EXAMINE THE ENVIRONMENT	FOLLOW UP AND FEEDBACK OF RESULTS OF DECISION	PHASE III: MEASUREMENT

Exhibit 7-DECISION MODEL COMPARISONS

Organizations must be able to grow, adjust,and improve if they are to survive the environmental challenge of a free and competitive society. Accomplishment of tasks is not enough. All tasks should be performed better than could be done otherwise or, if not, change must take place until this condition is alleviated.

B. THE CORPORATE DECISION FRAMEWORK

The basic structure of successful corporations includes a comprehensive framework of suborganizational decision cycles at all levels of management. The nodes of this framework consist of "decision-centers" which are subsystem activities responsible for at least one, possibly many, complete decision cycles. All decision-making functions conducted within organization decision-centers, and which, in the aggregate, comprise the corporate decision-making process, can be classed as either perceptive, adjustive, or corrective.

Perceptive decisions cause system alterations to occur which contribute to corporate evolution and growth. They are usually unstructured and involve a substantial amount of foresight, insight, and initiative. This class of decision is associated with medium to high levels of uncertainty, risk, and long-term corporate benefit.

Adjustive decisions are made in response to change in the internal or external environment. They cause

system modifications to occur which accommodate or exploit environmental variations. This class of decision is adaptive in nature, usually semi-structured or structured, involves medium to low levels of uncertainty, risk, and near-term impact on the organization.

Corrective decisions cause system changes which improve or maintain observable efficiency or performance within the present environment. They are typically structured or semi-structured-type decisions, involve minimum levels of uncertainty, risk, and low to medium levels of system impact.

Exhibit 8 exemplifies the relationship between decision level, class, and type, and presents examples of the kinds of decision problems which could be associated with various elements of the corporate decision framework model. Partitioning of decision problems within the model is not an exclusive distinction since any corporate problem requiring action can and usually does involve decisions of many kinds as part of the decision center revolution. It should be noted that the higher the decision center level which must address the problem, the more kinds of decisions will ultimately be involved in the decision cycle process. That is, strategic-level decisions precipitate a multitude of tactical decisions which elicit an even greater number of operational decisions.

This section has explored the nature of decision-making processes within the business organization,

DECISION LEVEL

STRATEGIC	TACTICAL	OPERATIONAL		DECISION CLASS/DECISION TYPE
ENTER NEW FIELD(S)?	ACCELERATE R&D EFFORTS?	AUTOMATION?	S	PERCEPTIVE
ACQUIRE OTHER FIRMS?	DEVELOP CORPORATE MIS?	STOCKPILE SCARCE MATERIALS?	SS	
BUILD NEW PLANTS?	ENTER NEW MARKETS?	MODERNIZE EQUIPMENT?	US	
CORPORATE MERGER?	INCREASE PRODUCTION CAPACITY?	MODIFY PROCEDURES?	S	ADJUSTIVE
EXPAND PRODUCT LINE?	MODIFY EXISTING PRODUCTS?	INCREASE PRODUCTION?	SS	
RELOCATE?	MODIFY PRODUCT MIX?	TRANSPORTATION MODE?	US	
CHANGE PUBLIC IMAGE?	NEW MARKETING EFFORT?	ALTER PRODUCTION PROCESS?	S	CORRECTIVE
REORGANIZE?	HIRE NEW TALENT?	REASSIGN PERSONNEL?	SS	
BUILD WAREHOUSE?	EXPAND SALES FORCE?	REPLACE EQUIPMENT?	US	

Exhibit 8-EXEMPLARY CORPORATE DECISION FRAMEWORK MODEL

developed descriptive models of these processes at the suborganizational level and in the aggregate, and catagorized corporate decision-making functions by decision level, class, and type. It is believed that frequent reference to this material will allow the information system manager to better understand, and thus better serve, the organization decision centers.

Information management can only be effective if there is some feeling for the relative worth of products produced. The next section explores the information valuation problem.

V. AN APPROACH TO INFORMATION VALUATION

In a free and competitive environment, the conflict between producer and consumer is simply a matter of balance. Each side has special interests which must be reconciled before a mutually satisfactory transaction can take place. The supplier of products expends resources and expects a marginal profit in return. On the other hand, product usefulness has to be equal to or in excess of cost before there can be a viable market. In an open marketplace, a natural balance will exist between producer and user interests as long as the user has access to competitive product substitutes [Ref. 11]. However, when producer and consumer exist within a common agency the law of supply and demand by which balance is maintained is severly distorted resulting in the need for some type of artificial control.

Within the corporate structure, the MIS (management information system) is a producer of information products. The consumers of and marketplace for these products are the organization decision-centers. Their purpose is inexorably bound to the goals and objectives of the organization which they support. Justification for the manufacture of MIS products is found in the corporate benefit expected as a result of their use, or, from another viewpoint,

the degradation in corporate benefit if their production is stopped. The first is an apriori judgement of value whereas the latter is a posteriori assessment of worth.

Regardless of the estimated value assigned to MIS products, their usefulness is only measured by the extent management elects to rely on them when making decisions. The point is often made that the intrinsic value of information is independent of utilization. That is to say, the failure of responsible decision-makers to use this information in no way lessens its actual, albiet unrecognized, importance to the organization. The logic of this argument is unassailable. However, when dealing with corporate profitability or benefit, a basic distinction between the "value" of information and its "worth" to the organization must be made.

Information which has value can be an important, although often ephemeral, organization asset. However, the value realized, or worth, is primarily a function of the extent to which management uses it to reduce uncertainty. These are the type of considerations which cloud the picture when attempting to valuate information. Should MIS products be judged by their assumed value, perceived usefulness, corporate worth, or just the comfort of feeling secure in the belief that, with regard to information, more is better than less? If MIS products were free, all of the above might apply equally well. In the real world, all information products cost and corporate

resources are limited. The economic reality of competition demands that each organization develop an efficient and responsive MIS network, and that tight control be maintained over information product quality, quantity, cost, and effectiveness. Accomplishment of this objective requires some type of systematic approach to information valuation.

A. A VALUATION MODEL

MIS products reduce uncertainty during corporate decision cycles and thereby benefit the organization. Each has three identifiable attributes by which it can be judged; value: benefit expected from availability, utility: relative usefulness, and worth: benefit achieved through utilization. Value, utility, and worth; a dynamic assessment of these pseudo-quantifiable information product characteristics is the key to meaningful information valuation and involves problems of expectation, application, and realization, respectively.

Expectation is an investment concern--what marginal return will occur from production and how does it compare with available alternatives? Most often, estimating the value of information is quite subjective and based on various assumptions which may or may not be valid. However, a reasonable estimation of the maximum beneficial impact of information availability should always be made

prior to commitment of resources toward its production. Furthermore, the expected benefit should be periodically compared with that actually realized in order to expose major variances or misconceptions.

Application is a consumer or user concern--does this information help me to perform my job? The main worry of organization decision-makers is that their decisions are correct. Toward this end, information is used to reduce the risk of being wrong. Decision-center performance is judged by accrual of tangible and intangible corporate benefits directly attributable to various decision actions. Accordingly, organization decision-makers will use those information products or product alternatives that they feel most familiar with and have the most confidence in. Communication and cooperation between user and producer when developing information products will help assure that corporate managers receive products they will use.

Realization is the post-facto payoff of information production--what identifiable benefits are a result of information use? The worth of information is an indication of how much value is being realized. Assessment of worth is often subjective, with benefits difficult to trace. But, the important point to be made here is that some type of continuing product evaluation is required in order to purge the information network of products which hinder or suppress the natural profitability of such systems.

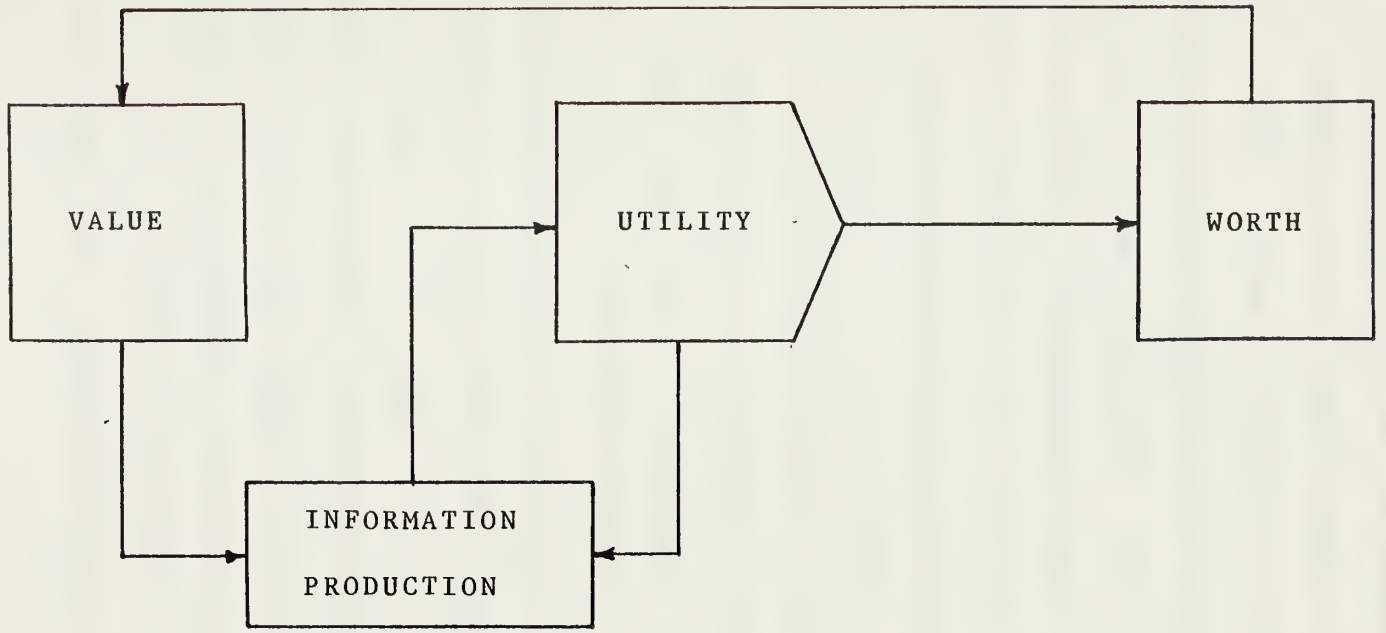
A qualitative information valuation model which summarizes concepts just discussed is shown as Exhibit 9. The process described represents a self-governing system with feedback control on the prime output variable, worth.

B. THE PRODUCT-WORTH FUNCTION

In order to assess the relative importance of information products, a closer look at the three information product attributes is necessary:

1. Product value is an independent characteristic which can be achieved as a result of optimum utilization.
2. Product utility is a function of product preparation, dissemination, and user perception, and is relatively independent of product value. It is a measure of product usefulness.
3. Product worth is the marginal benefit attributable to product use and is dependent on product value and utility.

Using inductive reasoning,formulation of an empirical relationship between product value, utility, and worth is possible. Such a relationship, when graphically depicted will describe a "product-worth function" for information products which may be of use when addressing the information valuation problem.

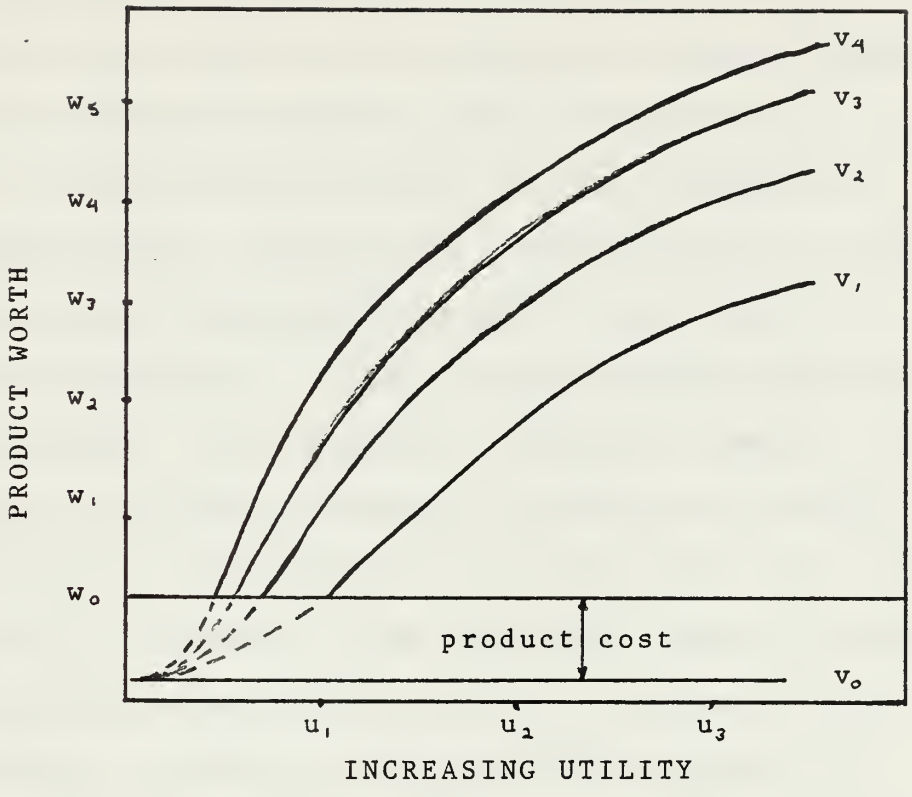


EXPECTATION	APPLICATION	REALIZATION
ASSESS BENEFIT WHICH SHOULD RESULT FROM PRODUCTION	ASSESS THE RELATIVE IMPORTANCE OF PRODUCT TO JOB PERFORMANCE	ASSESS ACTUAL BENEFIT ATTRIBUTABLE TO USE OF THE PRODUCT

Exhibit 9-INFORMATION VALUATION MODEL

The intrinsic value of information, not to be confused with estimated value, is variable with time and circumstance. However, this value can be assumed to remain relatively constant over finite periods during which product use can vary. Thus, a family of equivalue curves can be generated which describe the marginal impact of changing utility on product worth. This same approach can be used to determine the marginal effect of changing value on product worth for fixed levels of utilization. Exhibit 10 describes an emperically derived set of product-worth function curves which are general in nature and which have an ordinal relationship. That is, no particular meaning or significance is attached to the scale that is used, or to the magnitude of difference between any of the curves. The main inferences that can be made are: (1) that increasing levels of value and utility are preferable to decreasing values since this tends to cause an increase in product worth, and (2) that products with equal worth, as determined from the combined attributes of value and utility, are equal in the eyes of the organization. This is the nature of modern utility theory as developed by Hicks and Hotelling [Refs. 12 and 13] and provides the basis for a possible approach to information valuation.

The product-worth function of Exhibit 10 can be used to develop equi-worth boundary lines representing organizational indifference to information products having



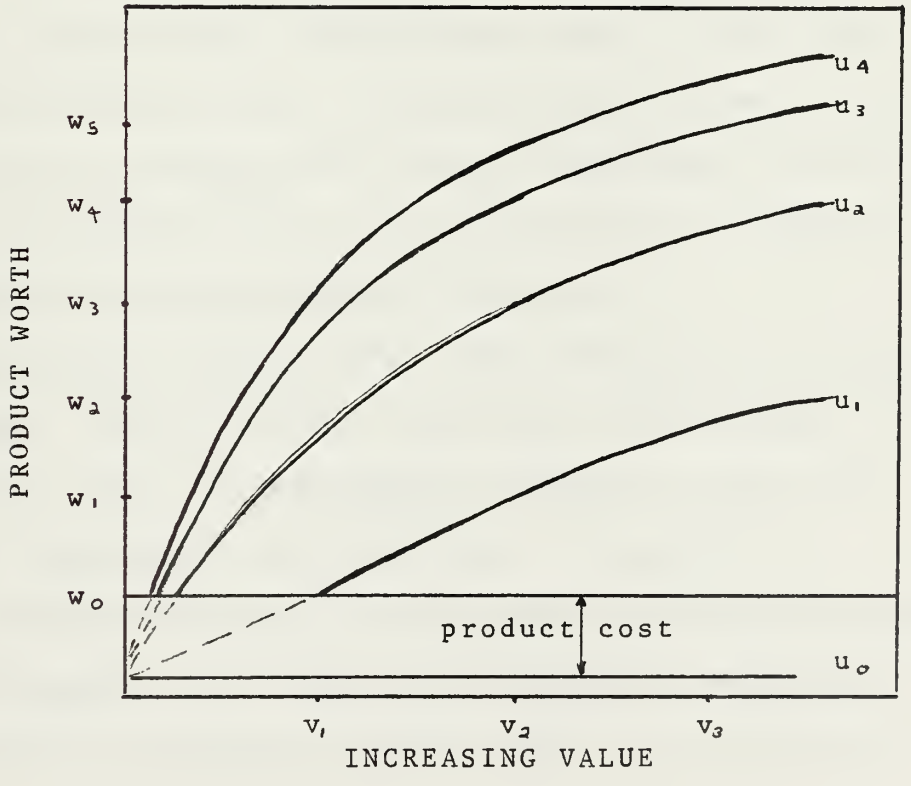


Exhibit 10-PROPOSED PRODUCT-WORTH FUNCTION

comparable combined attributes of value and utility. These generalized indifference curves are shown in Exhibit 11. The limiting factor on worth as use of the product increases is the potential value of this information to the organization, whereas the limiting factor of worth as value becomes increasingly great is the extent to which this information is used by appropriate organization decision-centers. With regard to corporate benefit, it makes little difference whether an information product has a value of v_4 and utility of u_1 or a value of v_1 and utility of u_2. However, it is generally less of a problem to increase product utility than to increase value and, therefore, products having high value should be favored over those having high utility when they lie on the same product-worth indifference curve. Note that information products which characteristics cause to fall outside the w_0 boundary are obvious candidates for elimination or alteration since cost of production exceeds any benefit that is being realized from use.

This section defined three basic information product attributes: value, utility, and worth, with which a generalized model of information valuation within the business organization was developed. In addition, product-worth indifference curves were empirically derived and are suggested as a basis for systematic evaluation of management information system output in conjunction

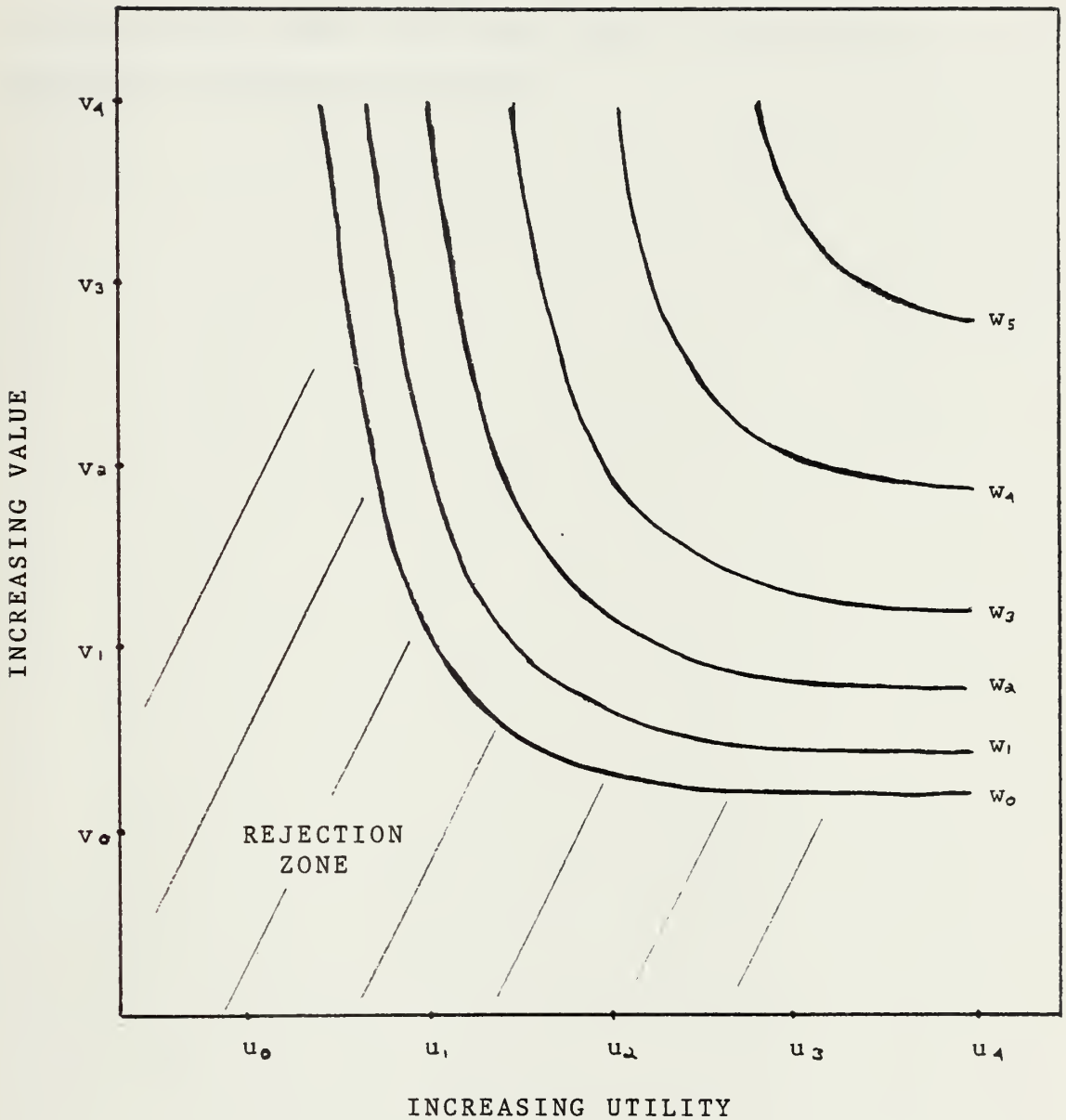


Exhibit 11-PRODUCT-WORTH INDIFFERENCE CURVES

with the proposed valuation model. The problem still remains to select or develop reliable assessment techniques to quantify information product attributes and is an appropriate topic for thesis work in the area of management information systems.

VI. SUMMARY

The business organization can be modeled as five functional subsystems: productive or technical, supportive, maintenance, managerial, and adaptive. These subsystems, which would otherwise be disjointed, are synergistically bound by means of structured information processes and a network of information flow.

Information products fall under six basic support categories: strategic, tactical, operational, fiscal, administrative, and general. All but the last reduce uncertainty associated with the corporate decision-making process and are products of the management information system.

Change to a corporate system involves a cyclic decision process performed in three general phases: recognition, implementation,and assessment. Decision cycles occur at all levels of the organization and are the responsibility of organization decision centers. Taken in the aggregate, they represent the corporate "decision revolution"--a hierarchial sequence of management tasks consisting of consideration, approval, alteration, evaluation, acceptance, measurement, assessment, and innovation. All managerial decisions can be classified as either perceptive, adjustive, or corrective, and are

associated with problems of corporate growth, environmental change, and system efficiency.

Management information products reduce uncertainty during corporate decision cycles and thereby benefit the organization. Each has three identifiable attributes: value (benefit potential), utility (relative usefulness), and worth (benefit realized). Worth is the cumulative measure of organizational impact and, therefore, the most indicative of information product importance. It can be related to value and utility by means of the "product-worth function." Use of the product-worth function to create a generalized set of product-worth indifference curves provides the basis for a systematic approach to the problem of information valuation.

The danger of developing information systems which are inefficient, ineffective, and wasteful is ever present. Such systems tend to emphasize quantity and not quality of output and the production of information becomes an end in itself. Prevention requires that management maintain an awareness of the fundamental role of information production in the organization.

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